

REMARKS

Status of the Claims

Claims 1, 5-12, 14-15, and 22-29 are pending in the present application. Claims 2-4, 13, and 16-21 were previously canceled. Claim 30 is presently canceled. Claim 9 is amended for clarity and for consistency with claim 26. No new matter is entered by way of this amendment. Reconsideration is respectfully requested.

Objections to the Specification

The Examiner maintains the objection to the specification as allegedly failing to comply with MPEP 608.01(a) and 37 CFR 1.71(b), *see Office Action*, page 5. According to the Examiner, paragraphs 4-24 of the present application appear to detail the field of the invention, however, absent section headings, the specification does not set forth in such manner as to distinguish the instant invention from other inventions and from what is old, *see Office Action*, page 5.

Applicants submit that section headings are not required. The MPEP states at 608.01(a) ¶ 6.01, which is entitled “Arrangement of the Sections of the Specification in a Utility Application” that the “following guidelines illustrate the *preferred* layout for the specification of a utility application. These guidelines are *suggested* for applicant’s use”, *emphasis added*. Further, 37 CFR 1.71 (a), states that the specification must include a written description of the invention or discovery and of the manner and process of making and using the same, and is required to be in such full, clear, concise, and exact terms as to enable *any person skilled in the art or science* to which the invention or discovery appertains, or with which it is most nearly connected, to make and use the same. Applicants submit that, contrary to the Examiner’s assertions, the specification is drafted such that an ordinary artisan can distinguish the instant invention from the prior art. Accordingly, Applicants respectfully request withdrawal of the objection.

However, if the application is otherwise in condition for allowance, the Examiner is invited to contact Linda T. Parker, Ph.D., Reg. No. 46,046, at the telephone number indicated below, and insertion of appropriate subheadings will be authorized.

Issues Under 35 U.S.C. § 112, Second Paragraph

Claims 9 and 30 are rejected under 35 U.S.C. § 112, second paragraph, as allegedly indefinite. Specifically, the Examiner states that claim 9 is unclear for the recitation “amount of liquid will be less than 30% of the dry matter content of the pre-mixture”, *see Office Action*, page 6. Specifically, the Examiner states that it is unclear if this percentage is, *e.g.*, a percent by weight or volume, *see Office Action*, page 6. The Examiner further states that there is a lack of antecedent basis for the phrase “an acidic ion exchange resin” in claim 30.

Claim 30 is canceled. Accordingly, the rejection is moot in regard to this claim.

Claim 9 is amended to clarify that the total amount of liquid is less than 30 % wt-% of the dry matter content of the pre-mixture. Accordingly, Applicants believe the rejection is overcome and request the rejection be withdrawn.

Issues Under 35 U.S.C. § 103(a)

Claims 1, 5-12, 14, 15, and 22-30 are rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over U.S. Patent No. 3,346,558 to Roth, (“Roth”) in view of Leiteiser *et al.*, *Ind. Eng. Chem. Res. Dev.*, 1966, 5:276-282, (“Leiteiser”). Specifically, the Examiner states that Roth discloses a process for preparing polyol-glycosides comprising reacting starch, polyol and acid, at an elevated temperature and pressure using a screw-type extruder, *see Office Action*, page 8. The Examiner admits that Roth does not disclose an acidic catalyst that is phosphoric acid, H_3PO_4 , hypophosphorous acid, H_3PO_2 , and phosphorous acid, H_3PO_3 , *see Office Action*, page 9.

However, the Examiner states that Leiteiser teaches the use of an acidic catalyst of sulphuric acid and phosphoric acid, which is a phosphorous-containing acid that is a strong mineral acid, *see Office Action*, page 10. According to the Examiner, it would have been obvious to an ordinary artisan to combine the process for preparing polyol-glycosides by reacting starch, polyol and acid using a screw-type extruder disclosed by Roth with the acidic catalyst of sulphuric acid and phosphoric acid taught by Leiteiser, *see Office Action*, page 10. The Examiner states that an ordinary artisan is motivated to combine the references since Ross

teaches that any strong mineral acid can be employed, although Roth does not disclose the use of a phosphorous-containing acid, *see Office Action*, page 11. Applicants respectfully traverse.

Claim 30 is cancelled. Accordingly, the rejection is moot in regard to this claim.

The burden is on the Examiner to make a *prima facie* case of obviousness, which requires an objective analysis as set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966). In *KSR International v. Teleflex Inc.*, 82 USPQ2d 1385 (2007), the Court affirmed that this analysis includes the following factual inquires: (1) determining the scope and content of the prior art; (2) ascertaining the differences between the claimed invention and the prior art; and (3) resolving the level of ordinary skill in the pertinent art. The Examination Guidelines for Determining Obviousness Under 35 U.S.C. § 103 in view of the Supreme Court Decision in *KSR International Co. v. Teleflex Inc.* state that, having undertaken the factual inquires of *Graham*, a rejection under 35 U.S.C. § 103 may be supported by one or more of the following rationales: (1) combining prior art elements according to known methods to yield predictable results; (2) simple substitution of one known element for another to obtain predictable results; (3) use of a known technique to improve similar devices in the same way; (4) applying a known technique to a known device ready for improvement to yield predictable results; choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; (5) variations that would have been predictable to one of ordinary skill the art; and (6) some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine the prior art reference teachings to arrive at the claimed invention. 72 Fed. Reg. 57526, at 57529 (October 10, 2007). Each of the above-noted rationales requires predictability in the art and/or a reasonable expectation of success, and the Examiner must consider objective evidence, which rebuts such predictability and reasonable expectation of success. This objective evidence or secondary considerations may include unexpected results and/or failure of others (e.g., evidence teaching away from the currently claimed invention), evidence of commercial success, and long-felt but unsolved needs, as found in the specification as-filed or other source. *Id.* When considering obviousness of a combination of known elements, the operative question is “whether the improvement is more than the predictable use of prior art elements according to their established functions.” 82 USPQ2d at 1389.

Independent claim 1 is directed to a process for manufacturing transglycosylation products, comprising the steps of: reacting a starch ester or starch ether at acidic conditions with an alkanol containing 1 to 6 hydroxyl groups in the presence of an acidic catalyst in a transglycosylation reaction to form a reaction mixture, wherein said acid catalyst comprises phosphorous, and recovering a transglycosylation product, or subjecting the transglycosylation product to further processing, characterized in that the reaction is performed in a reactive extrusion process essentially without any medium, and the reaction mixture is conducted through an extrusion device via at least two separately adjustable heating zones, thereby providing control of heat introduced externally into the reaction mixture, wherein the acidic catalyst is a phosphorus-containing acid selected from at least one of the group consisting of: phosphoric acid, H_3PO_4 , hypophosphorous acid, H_3PO_2 , and phosphorous acid, H_3PO_3 , and wherein the catalyst is allowed to chemically bond with the transglycosylation product.

Roth discloses a process for preparing polyol-glycosides comprising reacting starch, polyol and acid at an elevated pressure using a screw-type extruder. Roth teaches that sulfonic acids, such as para-toluene sulfonic acid, are preferred, since strong mineral acids have a tendency to pit the apparatus in which the reaction is being carried out and yield polyol-glycosides of somewhat darker color than the sulfonic acids, *see* column 3, lines 30-40, examples, *e.g.*, Table 1.

According to the Examiner, Leitheiser teaches a phosphorous-containing acid that is a strong mineral acid, *see Office Action*, page 10. In particular, the Examiner states that Leitheiser describes the use of a sulphuric acid and phosphoric acid catalyst, *see Office Action*, page 10.

In contrast to the cited references, the instant claims specify that the acidic catalyst is phosphoric acid, H_3PO_4 , hypophosphorous acid, H_3PO_2 , and phosphorous acid, H_3PO_3 . Neither Ross nor Leitheiser, alone or in combination, teach these elements.

Further, Applicants submit that Roth teaches away from the phosphorus-containing acid catalyst described in the claimed method, since Roth states that sulfonic acids are preferred, given that strong mineral acids yield polyol-glycosides of somewhat darker color than the sulfonic acids.

In addition, as described further below, Applicants submit that the use of the phosphorus-containing acid catalysts, as specified in the instant claims, results in advantages that are unexpected in view of the cited references. Specifically, products obtained from the presently claimed methods demonstrate superior properties, which are useful for adhesives including hot melt adhesives.

Applicants provide herein comparative testing data with respect to the disclosure of Roth and the claimed method, which demonstrates how the preferred acid of Roth, *i.e.* para-toluene sulfonic acid, works during reactive extrusion, as compared to the phosphorous-containing acid described in the claimed method, as exemplified by hypophosphoric acid.

Applicants prepared two materials, one using hypophosphoric acid as a catalyst and one using para-toluene sulphonic acid as a catalyst. Specifically, 20 g of acetylated starch and ethylene glycol (15 w-% of starch acetate) and 0.5 g of catalyst were melt-mixed at 180 °C using a compounder (DACA Instruments). In two first experiments, a material was prepared using hypophosphoric acid as a catalyst, and two latter experiments, a material was prepared using para-toluene sulphonic acid as a catalyst. Two samples were prepared with both catalysts, the mixing times employed for the samples being 5 min and 10 min, respectively. The materials obtained formed transparent, plastic-like products during compounding. The material with the para-toluene sulphonic acid as catalyst was somewhat darker in color. For analyzing the color stability in a melt state, samples of both materials were placed in an oven for 6 h. The oven temperature was 160 °C.

After heating for the indicated period of time, the color of the materials was visually examined and photographs were taken of the samples, *see* Exhibit A and Exhibit B. As is evident in the enclosed photographs, the color of the material prepared using para-toluene sulphonic acid as a catalyst was very dark, while the color of the material prepared with a catalyst according to the instant claims did not change during heating.

Further, the molecular weights of the samples were determined after preparation and after heat-treatment. The molecular masses of the materials are shown in the enclosed analysis data both after the transglycosylation reaction and after a 6 hour heating at 160 °C. *See* Exhibits C, D, E, and F. Exhibits C and E describe the materials obtained using para-toluene sulphonic acid

before and after heat treatment, respectively. Exhibit D and Exhibit F, describe the materials using the phosphorus-containing acid catalyst, encompassed by the claimed methods, before and after heat treatment, respectively.

After the transglycosylation reaction, but before heat treatment, the materials obtained from the claimed methods using hypophosphoric acid, result in a bimodal molecular weight distribution. The value of the higher molecular weight range being weight average (M_w) = 1,159,987 and numerical average (M_n) = 668,684 and for the lower molecular weight range: M_w = 119,765 and M_n = 97,398, *see* Exhibit E. Using para-toluenesulfonic acid, the values were M_w = 36,532 and M_n 23,343, *see* Exhibit C. No bimodality could be seen. As is apparent from the Exhibits, para-toluene sulfonic acid results in strong degradation and a much lower molecular weight than that observed with hypophosphoric acid.

When the products were heated for 6 hours, the molecular weights were lowered for both different kinds of material, but the molecular weights of the materials encompassed by the claimed methods remained much higher. For the material obtained using hypophosphoric acid: M_w = 174,508 and M_n = 80,620, *see* Exhibit F. After heating, the material encompassed by the claimed methods was monomodal. For para-toluenesulfonic acid catalyzed samples, the molecular weights after heating were very low, viz. M_w = 8,426 and M_n = 5,315, *see* Exhibit D.

Furthermore, the materials obtained according to the instant claims are useful as adhesives. That is, the claimed methods provide a product with a suitable molecular weight distribution for adhesives since polymeric molecules are obtained that have both a high molecular weight and a low molecular weight. The portion of material obtained from the claimed methods, which has high molecular weight, imparts strength and film-forming properties, while the lower weight portion reduces viscosity. No such molecular weight distribution is observed from the product obtained using para-toluene sulfonic acid; rather the material has inferior properties.

Moreover, the products obtained using the instant claimed methods are suitable as hot melt adhesives; they have excellent properties after extended heating as shown by the enclosed results. The products obtained from the instant claimed methods maintain a high molecular weight and the color is unchanged. By contrast, the product according to the Roth reference

cannot be used as adhesive. It becomes brittle after heating; viscosity drops. Brittleness will cause the glue joint to yield under stress. The material according to the present invention is instead viscous and flexible, as required for a good adhesive.

Based upon the foregoing, Applicants submit that the instant claims are not rendered obvious by the cited references. Accordingly, Applicants respectfully request withdrawal of the rejection.

CONCLUSION

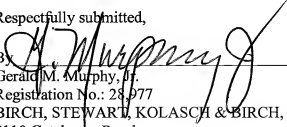
In view of the above amendments and remarks, Applicant believes the pending application is in condition for allowance.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Linda T. Parker, Ph.D., Reg. No. 46,046, at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.17; particularly, extension of time fees.

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Respectfully submitted,

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